Renew-A-Bean Lab

**Background**:
 Prediction of how long various energy resources will last is risky at best. In the early 1970s it was predicted that we would run out of natural gas by the late 1980s. In the 1950s, utilities predicted California would need a nuclear power plant every 10 miles along their coastline to meet their electrical energy needs. It is important to know whether a prediction assumes a constant rate of use or a changing rate. It is also important to know whether a rate assumes the more resources will be found, or it assumes use of only known reserves. It is also important to consider if foreign resources are included.
 The point of this activity is not so much to show actual numbers, but rather that nonrenewable resources will be depleted and that conservation (reduction of use or waste) together with the development of renewable resources can extend the availability of nonrenewables. Because the US depends on nonrenewable energy and because the human population is growing (thereby demanding more energy) we face the eventual depletion of this resource. But when? It all depends on how much we use energy. If all our energy were renewable we wouldn’t have a problem. There would always be enough energy. You will experiment with these conditions to see how long you can extend the use of energy resources.

**Intro Questions**:
 1. What does it mean for something to be a renewable resource?

2. What does it mean for something to be a nonrenewable resource?

3. If you were given 200 beans, and needed to place 92% of those beans in a jar how many would you use?

4. What would happen if they only filled the milk cartons in the cafeteria once a year?

This pie chart shows the actual consumption breakdown for the US in 2006. The US derives 97% of its total energy from nonrenewables.

7% Nuclear

**Materials**:
A Jar or Bowl
Black Beans
Blackeyed Peas
Renewables Data Sheet
Draw Chart
Blindfold

3% Solar, Hydro, and other Renewables

44% Petroleum

23% Coal

23% Natural Gas

**Procedure**:
1. Fill your container with exactly 100 beans. 92% should be black beans, 8% should be blackeyed peas.
2. Place the blindfold over the eyes of one student in your group. This represents a population that is using energy without think about whether it is renewable or nonrenewable.
3. Review the rules on your draw chart.
4. Predict how many years it will take to deplete the beans in the container. Record this on Data Chart 1.
5. Remove the number of beans indicated on your draw chart for each trial, one year at a time.
 \*Renewables can be returned to your container and counted towards the year.
6. Continue until only renewable beans are left in the container. Calculate the percentages of renewable and nonrenewables that remained after each drawing.
7. Record the number of years it took to deplete all nonrenewable beans on Data Chart 2. Compare this number to your prediction.
8. Record steps 2-7 for Data Charts 2 and 3. These charts represent populations with varying degrees of energy consumption. These would be populations much like ours in the US and other “developed” nations. Countries with a high standard of living consume much more energy than developing, or third world, nations. This simulation is designed to show how quickly a growing consumption level can deplete a resource.
9. Design a way to extend the use of energy resources for as long as possible. The rules remain the same, however. A student must be blindfolded, and they must begin by removing 10 beans. You should establish a rate of consumption that will last longer than either of your previous trials. Record your trials in the remaining data charts (4 and 5). You should run at least two trials.

**Analysis Questions**:
1. What types of energy will people be using in the future? Why?

2. Why don’t people use more renewable energy now?

3. Are there reasons to use more renewable now rather than wait until the nonrenewables run out?

4. What are some easy things we can do to conserve nonrenewables?

**Conclusion**:
On a separate sheet of paper, or in the space below data chart #1, summarize today’s lab in 6-8 sentences. What was proven? What did you learn? Why did we do this lab? These should be answered by referencing your data.

\*The following data charts tell you how many beans to pull out of the container depending on the energy consumption rate you choose to simulate. Before beginning each year, predict how long it will take to remove all of the nonrenewable beans. Complete the chart by recording the number of all beans left after each draw. Then, calculate the percentage of nonrenewable and renewable beans that remain.

**Rules for Data Collection**:
1. Remove only the number of beans indicated on the chart.
2. Always remove 10 beans the first year.
3. Put renewable beans back in the container after each pull. Count only the beans left in the container. NOTE: You may not be able to fill in all the boxes to year 12; or you may have to extend the chart.
4. The student pulling the beans out must be properly blindfolded. Consider it cheating if you pull beans based on how they “feel”!
5. Keep all beans where they can be counted and returned to the jar.

Data Chart #1:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Consumption Level | Prediction: Years to Deplete: | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 | Total Years |
| Constant: Remove 10 beans each year |  | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |  |
| Record Number of Beans Remaining in Container |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| % Nonrenew.% Renewable |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Feel free to use this extra space for your conclusion! ☺

Data Chart #2:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Consumption Level | Prediction: Years to Deplete: | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 | Total Years |
| Constant: Remove 5 more beans each year |  | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 |  |
| Record Number of Beans Remaining in Container |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| % Nonrenew.% Renewable |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Data Chart #3:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Consumption Level | Prediction: Years to Deplete: | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 | Total Years |
| Constant: Remove 10 more beans each year |  | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| Record Number of Beans Remaining in Container |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| % Nonrenew.% Renewable |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Data Chart #4:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Consumption Level | Prediction: Years to Deplete: | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 | Total Years |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Record Number of Beans Remaining in Container |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| % Nonrenew.% Renewable |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Data Chart #5:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Consumption Level | Prediction: Years to Deplete: | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 | Total Years |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Record Number of Beans Remaining in Container |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| % Nonrenew.% Renewable |  |  |  |  |  |  |  |  |  |  |  |  |  |  |